second current I2 to the electronic device **2**. Accordingly, the energy storage device **1** provides the electronic device **2** with sufficient electricity.

[0051] At time T**5**, the load current required by the electronic device **2** starts to fall (for example, the load current required by the electronic device **2** falls to 0.8 A). Meanwhile, the adapter **11** can provide the electronic device **2** alone with sufficient electricity. The analog level of the feedback signal EAO rises and the charger module **12** adjusts the duty cycle of the first PWM signal PWM**1** and the duty cycle of the second PWM signal PWM**2** according to the feedback signal EAO and the ramp signal RAMP so that the first turn-on time of the first switch Q**1** increases, while the second turn-on time of the second switch Q**2** decreases. As a result, the energy storage unit **13** reduces the second current I2 supplied to the charger module **12**.

[0052] At time T**6**, the input current I_{CIC} provided by the adapter **11** starts to fall due to load current required by the electronic device **2** decreases so that the input current I_{CIC} falls below the maximum safe current I_{max}. It should be noted that, meanwhile, the duty cycle adjustment unit **121** does not allow the negative current. Therefore, the zero-crossing current threshold I_{ZC} is adjusted to zero again.

[0053] Moreover, at time T**7** when the adapter **11** charges the electronic device **2**, the adapter **11** also charges the energy storage unit **13** at the same time to compensate for the energy loss of the energy storage unit **13** in the boost mode.

[0054] If the input current I_{CIC} provided by the adapter **11** rises again to be higher than or equal to the maximum safe current I_{max} of the adapter **11**, the charger module **12** enters the boost mode again so that the energy storage unit **13** assists the adapter **11** to provide the electronic device **2** with sufficient energy.

[0055] As stated above, the charger module according to one embodiment of the present disclosure can operate in the buck mode and the boost mode to achieve the buck and the boost function of the conventional energy storage device. In other words, compared to the conventional energy storage device, the energy storage device of the present disclosure has advantages of lower manufacturing cost, easier circuit design and less circuit area.

[0056] Moreover, the energy storage device according to one embodiment of the present disclosure exhibits faster response and more stable. The reason is that it takes much time for the processor in the conventional energy storage device to analyze the present conditions and correspondingly output the control signal to control the switching between the buck circuit and the boost circuit. Therefore, the conventional energy storage device fails to respond to the request of the electronic device in real time, which leads to longer response time.

[0057] Moreover, the energy storage device **1** according to one embodiment of the present disclosure adjusts the energy provided by the energy storage unit **13** and the input current I_{CIC} provided by the adapter **11** according to the present requirement of the electronic device **2**. Furthermore, when the load current required by the electronic device **2** is too high, the energy storage unit **13** starts to provide the electronic device **2** with electricity and the adapter **11** adjusts the input current I_{CIC} to be equal to the maximum safe current I_{max}. Therefore, the energy storage device of the present disclosure can overcome the problems of the conventional energy storage device due to unstoppable switching between the operation modes.

[0058] Generally, the inductor current I_L will flow from the energy storage unit **13** to the second switch Q**2** if the duty cycle adjustment unit **121** allows the negative current in buck mode. The negative current flows into the ground terminal through the second switch Q**2** to cause the poor charging efficiency of the energy storage unit **13**. Moreover, the negative current may also flow into the adapter **11** to damage the adapter **11**. However, in the present embodiment, the negative current is only allowed when the input current I_{CIC} is higher than or equal to the maximum safe current I_{max}. Moreover, the charger module **12** controls the duty cycle of the first switch Q**1** and the duty cycle of the second switch Q**2** to let the energy storage unit **13** assist in providing the electronic device **2** with energy.

[0059] Then, referring to FIG. **4**, FIG. **4** is a flowchart of a control method of an energy storage device according to one embodiment of the present disclosure. The control method is used with the energy storage device **1**. In Step S**401**, the adapter receives electricity from the utility and starts to provide an input current I_{CIC}. In Step S**402**, the detection unit detects the input current I_{CIC} provided by the adapter and determines whether the input current I_{CIC} is higher than or equal to a maximum safe current I_{MAX} of the adapter. When the input current I_{CIC} provided by the adapter is higher than or equal to the maximum safe current I_{MAX}, the method proceeds with Step S**404**. Otherwise, when the input current I_{CIC} provided by the adapter is lower than the maximum safe current I_{MAX}, the method proceeds with Step S**403**.

[0060] In Step S**403**, the charger module operates in a buck mode. The adapter supplies the input current to the electronic device to charge the electronic device. Moreover, the adapter supplies a first current to an energy storage unit to charge the energy storage unit. In other words, the adapter provides the electronic device and the energy storage unit with energy at the same time. The inner current of the energy storage device is expressed as: $I_{CIC}=I_{SYS}+I1$. Then, the method repeats Step S**402** to continue detecting the change in the input current.

[0061] In Step S**404**, the charger module allows the zero-crossing current threshold I_{ZC} to be lower than zero. In other words, the charger module allows the negative current. The duty cycle adjustment unit in the charger module adjusts the duty cycle of the first switch and the duty cycle of the second switch so that the energy storage unit supplies a second current to the charger module. The second current is reverse to the first current. Then, the charger module provides the electronic device with sufficient energy according to the second current. Accordingly, the charger module provides the electronic device with sufficient energy without damaging the adapter. The inner current of the energy storage device is expressed as: $I_{CIC}+I2=I_{sys}$. Then, the method repeats Step S**402** to continue detecting the change in the input current.

[0062] As stated above, the present disclosure provides an energy storage device and a control method thereof, using a control charger module to achieve assisting the adapter to charge the electronic device. Therefore, the energy storage device according to the present disclosure does not require a buck circuit and a boost circuit as in the conventional energy storage device. Compared to the conventional energy storage device operating based on a control signal to control the switching between the buck circuit and the boost circuit, the energy storage device according to the present disclosure